

A PRELIMINARY NOTE ON POLLINATION IN THE CHENOPODIACEAE

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Somewhat understandably, interest in pollination biology of members of the Chenopodiaceae has been scant (see Percival, 1965, who made no mention of the family), or else has focused on the "allergic reaction" caused by some members of the family (see Homan, 1963, discussion of *Chenopodium album* as a secondary factor during the ragweed season). Mode of pollination in chenopods is, we believe, open to question in many instances. The general supposition has apparently been that the family is more or less uniformly anemophilous (e.g., Wodehouse, 1935, 1945, 1971), this in association with an abundant, weedy habit. In accordance, Proctor and Yeo (1972) alluded to the significant presence of chenopodiaceous pollen in the "pollen rain." Perhaps the general impression is that chenopods are simply "uninteresting" in terms of pollination biology. However, if some literature is retraced, a rather different perspective may be gained. Volkens (1893) offered the proposition that most members of the family may actually be entomophilous. Knuth (1909) presented what remains as probably the most detailed account of pollination in the Chenopodiaceae, not to mention a number of other families. From his work one is left with the understanding that chenopods are generally either anemophilous or self-pollinated; however, Knuth did not exclude the possibility of insect visits to such taxa as *Salsola kali* L. More recently, Ponomarev and Lykova (1960) credited M. Iljin with the suggestion that entomophily is characteristic of the subfamily Spirolobeae (=Salsoloideae, cf. Blackwell, 1977), admitting, however, that the situation had not been adequately studied. Ponomarev and Lykova further credited Z. P. Bochantseva and T. Vitovich with establishing self-pollination in several taxa of chenopods, including certain species of *Salsola* in Asiatic desert-steppe areas. Ponomarev and Lykova themselves reported the existence of cleistogamy in *Petrosimonia triandra* (Pallas) Simonk and *Salsola brachiata* Pallas. However, they stated that cleistogamous flowers were actually no different structurally from chasmogamous ones, but rather, that the stamens in cleistogamous flowers simply did not become exerted (and consequently would shed pollen internally within the flower). They believed that cleistogamy could be quantified (on a percentage basis) merely by counting the number of flowers with included versus exerted stamens.

From the preceding brief account, it is obvious that pollination biology in the Chenopodiaceae is much in need of investigation, or reinvestigation as the case may be. Such studies might well result in views of pollination mechanisms in the family substantially different from those currently held. Whereas it is probably true that certain major segments of the family, e.g., a number of species of *Atriplex*, are predominantly wind-pollinated systems, anemophily may in fact not prove to be the overpowering rule for the Chenopodiaceae as a whole. Entomophily unquestionably plays a role in some genera. Although entomophily may

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TABLE 1.

Plant Species	Apparent Mode of Pollination	Probable Insect Pollinators
<i>Atriplex canescens</i> (Pursh) Nutt.	Anemophily	————
<i>Halogeton glomeratus</i> (Bieb.) Meyer	Entomophily	Ants: Formicidae
<i>Kochia scoparia</i> (L.) Schrader	Entomophily	Bees: Colletidae and Halictidae
<i>Salsola kali</i> L.	Entomophily	Bees: Colletidae and Halictidae Wasps: Sphecidae
<i>Sarcobatus vermiculatus</i> (Hook.) Torr.	Anemophily	————
<i>Suaeda suffrutescens</i> Wats.	Entomophily	Ants: Formicidae (eyed worker ants), possible aphid relationships Butterflies: Lycaenidae Bees: Colletidae and Halictidae Thrips: Phloeothripidae

well be more common in the Russian thistle subfamily (Salsoloideae), as allegedly indicated by Iljin, it is certainly not excluded from the other subfamily (Chenopodioideae), based for example on our personal observations of insect pollination in *Kochia scoparia* (L.) Schrader. Conversely, anemophily would appear to be the primary method in *Sarcobatus vermiculatus* (Hooker) Torrey, a member of the Salsoloideae. Thus, over-generalizing with regard to subfamily pollination differences would seem unwise at this stage. Self-pollination doubtless occurs here and there throughout the family. However, Proctor and Yeo indicated that sporophytically determined self-incompatibility, an obvious genetic incentive to outcrossing, is known in the Chenopodiaceae. Thus, the matter of cleistogamy in particular should be viewed critically, especially since personal observations indicate that, in *Salsola kali*, the inclusion and exsertion of stamens may be merely a developmental sequence on a given plant. Attempting to quantify “cleistogamy” (as done by Ponomarev and Lykova) would therefore derive statistics that would vary considerably depending on the time of day observations were made.

OBSERVATIONS

The preliminary pollination data presented are based on our field observations made in southeastern Oregon and northwestern Nevada of *Halogeton* (July, 1977), and in Arizona, eastern New Mexico and western Texas (August, 1980) of the other taxa listed (Table 1). These observations were admittedly accomplished during time stolen from other types of projects undertaken on various chenopods. However, care was taken to document the observations photographically and/or by the collection of insect specimens.

THE NEED FOR REASSESSMENT

The Chenopodiaceae would thus seem to provide an unexpectedly interesting source for the investigation of plant/insect relationships, e.g., *Suaeda suffrutes-*

cens with its ant (ant hills close by)–aphid–floral associations. A somewhat unusual feature may prove to be that of relatively large, colorful anthers of some chenopods serving as a primary (or sole) insect attractant (though not necessarily a reward). This is readily observed, for example, in *Salsola kali*, in which the bright yellow anthers become exserted from a small, hyaline, membrane-like perianth, virtually hidden in the leaf axil. Upon anther exsertion, yellow-faced bees (Colletidae) quickly sight the flowers, and progress rapidly from one “exserted” flower to another. Following pollination, the anthers senesce rapidly and turn brown. *Salsola kali*, since it is a weed, is an interesting case because the whole question of pollination in intrinsic versus non-intrinsic ranges comes to bear. *Suaeda suffrutescens* provides an example of red and yellow anther morphs occurring in different flowers. This situation may have potential for experimental studies of pollen load and pollen carry-over. Some *Suaeda* flowers contain a surprising amount of nectar. Studies of nectar volume and sugar concentration could furnish meaningful correlations with an apparent mode of ant pollination. Clearly, a thorough pollination study should be done of as many representative genera and species of the Chenopodiaceae as possible. This is a large, significant family, long neglected with regard to the varied pollination phenomena occurring. Especially interesting would be the investigation of generic (and perhaps specific) pollen design (utilizing SEM) in connection with the precise strategies of pollination in operation. It is hoped that our observations and comments will encourage pollination biologists to take a new look at members of the Chenopodiaceae, and the varied pollination dynamics we believe to exist among them.

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